Section X – Conclusions and Recommendations

1. Conclusions

The Chickamauga project is plagued with “concrete growth” that results from an alkali-aggregate reaction (AAR), which occurs when alkali in cement reacts with silicate or carbonate minerals in the aggregate. This reaction creates a gel that absorbs moisture and swells, expanding the concrete. When the concrete is restrained, the growth increases internal stresses causing cracking and movement of concrete monoliths. Movement causes equipment misalignment as well as structural stability problems. The growth does not appear to be slowing; therefore, major maintenance (normally not associated with a typical lock) is significantly increasing causing both expenses and lock outages.

During the past several years the Corps and TVA have worked together on engineering analyses, instrumentation and capital maintenance directly related to concrete growth at Chickamauga Lock. Both agencies agree that the lock has a finite life. One of two scenarios will determine the closing of Chickamauga Lock.

The first scenario is the economic cost of maintaining the lock will determine when the lock should be closed. With significant annual maintenance, Chickamauga Lock can be economically kept open until at least year 2010. Beyond that time, the accelerating rate of deterioration will increase both the frequency and cost of major repairs. This will result in more frequent and lengthy lock outages, and reduce the lock’s availability to users. This study has shown that replacement of the existing lock by 2010 is far more economical than trying to continue maintaining and repairing a “deteriorating” lock. Thus, the economic life of the lock is considered to extend only to 2010.

The second closure scenario is solely based on the structural integrity of the lock as a segment of the dam. Concrete growth and the associated cracking and movements diminish the margin of safety of the lock structures to resist the water pressure from the reservoir. Anchoring the lock walls to the foundation with steel tendons has

temporarily restored the necessary margins. TVA and the Corps have installed an instrumentation system at the lock to continuously monitor: 1) stresses in the concrete and 2) minute movements of the lock. When analysis of the data indicates that operational and/or structural limits have been reached, TVA's Dam Safety Officer will close the lock.

In addition to the structural problems, the Chickamauga Project has only one chamber, measuring 60 feet wide and 360 feet long. The lock was completed in 1940 to accommodate four standard barges (26'x175'). The towing industry has greatly increased its use of larger, higher capacity barges on the Tennessee River, such as the jumbo barge (35'x195') and the integrated, super jumbo, or tanker barge (52'x290'). The standard barge has disappeared from the Tennessee River and Chickamauga Lock. The Chickamauga Lock chamber will handle only one jumbo barge at a time.

Lockage problems at Chickamauga result from the growth in traffic, barge sizes, and the size and configuration of tows. The small lock at Chickamauga causes increased delays due to congestion and an increase in lock processing time due to more complicated tow configurations. These lockage problems represent a significant economic loss to the shipping industry and, ultimately, to the consumer.

Chickamauga Lock currently has an average tow processing time of 8 hours per tow. This is the highest average locking time in the Ohio River System. Locking time is comprised of both delay and processing time. Only four locks in the Ohio River System have a higher average delay time and none have a higher processing time.

The poor reliability and long processing time of the existing lock is hampering waterway transportation. Studies have identified 4.3 million tons of commodities that could move on the waterway at a rate savings with a reliable Chickamauga Lock.

The 75'x400' lock has the highest net benefits, with $1,960,000 and therefore is the NED plan. The 75'x400' lock satisfies study needs, opportunities, and objectives. It reduces the average transit time for the projected 7.5 million tons of traffic from the expected 13.7 hours per tow in 2010 to 8.2 hours in 2010. The lock is more efficient than the without-project condition, and facilitates safer transit through the project. Over the

long term, the 75’x400’ lock provides benefits to air quality, noise, and aquatic resources. River traffic is able to reliably transport larger quantities of goods, thus fewer numbers of trucks and railcars will be required. This results in improvements to air quality and less noise.

The 110’x600’ has some advantages which might be considered to outweigh the economic advantage of the 75'x400' lock (the net annual benefits for the 75'x400' lock exceed those of the 110'x600' lock by $0.7 million).

The 110’x600’ lock is superior in reducing lockage-transit time and facilitating safe movement of traffic. The shorter processing times associated with the 110’x600’ lock also relates to improved efficiency for the towing industry and reduces transportation cost. The 110’x600’ lock provides an additional $961,000 per year in transportation cost savings.

In the long term, the 110’x600’ is considered to provide greater environmental benefits, and is the environmentally preferred plan.

While the 75’x400’ lock is the most cost-effective of the alternatives considered, the difference in net benefits between the 75’x400’ and 110’x600’ lock is only $697,000. The difference in initial construction costs between the two lock sizes is less than $26 million or only 10.7 percent more than the cost of the 75’x400’ lock.

The 110’x600’ lock is compatible with all the downstream Tennessee River main chamber locks (with the exception of the 1,000 foot chamber at Pickwick Landing). The 110’x600’ lock size is also compatible with lock chambers on the Ohio River to Pittsburgh, PA and on the Upper Mississippi River.

2. Recommendations

Having carefully considered the environmental, social, economic, engineering and public safety aspects of maintaining commercial navigation on the Upper Tennessee River at Chickamauga Lock and Dam, and in compliance with the Principles and Guidelines, I recommend that the NED Plan (a replacement lock 75 feet wide by 400 feet long) be authorized for construction as a Federal project, with such modifications as, at the discretion of the Chief of

Engineers, may be advisable. The total estimated cost of this project, based on October 2001 prices and conditions, is $239.4 million. Annual operation and maintenance for the Chickamauga Lock, as modified by this recommendation will not increase current expenses. Project financing is to be in accordance with Section 102 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation neither of a national civil works construction program nor of the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and/or implementation funding.

It is recognized that a replacement lock 110 feet wide by 600 feet long is economically justified, provides significant non-economic advantages over the recommended plan, and is supported by the navigation industry and TVA. These advantages may be determined to outweigh the slight economic advantage of the 75'x400' lock (the net annual benefits for the 75'x400' lock only exceed those of the 110'x600' lock by $0.7 million). If authorized, the 110'x600' replacement lock could be constructed at a cost of $265.2 million.

Cost sharing for the 110’x600’ lock could either be in accordance with Section 102 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended in whole or in conjunction with a non-Federal cost sharing partner funding the difference in cost between the two plans ($25.7 million).

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